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291 F.3d 1317, 62 U.S.P.Q.2d 1846
(Cite as: 291 F.3d 1317)

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United States Court of Appeals,
Federal Circuit.
COOPER CAMERON CORPORATION, Plaintiff-Appellant,
v.
KVAERNER OILFIELD PRODUCTS, INC., Defendant-Cross-Appellant.
Nos. 01-1383, 01-1408.

May 14, 2002.
Rehearing and Rehearing En Banc Denied July 11, 2002.

In patent infringement suit, the United States District Court for the Southern District of Texas, Judge Nancy F. Atlas, J., granted defendant's motion for summary judgment of noninfringement of patent directed to subsea wellheads having a horizontal spool tree arrangement that protects the integrity of the well during "workover" activities for repair and maintenance and its motion for summary judgment that the asserted claims another patent were invalid for inadequate written description, and assignee of patents appealed. The Court of Appeals, Lourie, Circuit Judge, held that: (1) assignee was foreclosed by the all-limitations rule from asserting infringement under the doctrine of equivalents; (2) patent was not invalid for failure to meet the written description requirement; and (3) fact issue existed as to whether certain reports were "printed publications" under statute governing conditions of patentability.

Affirmed in-part and reversed in-part.

West Headnotes

[1] Patents 291 ⚿314(5)

291 Patents
291XII Infringement
291XII(C) Suits in Equity
291k314 Hearing
291k314(5) k. Questions of Law or Fact. Most Cited Cases
A determination of infringement, whether literal or under the doctrine of equivalents, is a question of fact.

[2] Patents 291 ⚿168(2.1)

291 Patents
291IX Construction and Operation of Letters Patent
291IX(B) Limitation of Claims
291k168 Proceedings in Patent Office in General
291k168(2) Rejection and Amendment of Claims
291k168(2.1) k. In General. Most Cited Cases

Patents 291 ⚿237

291 Patents
291XII Infringement
291XII(A) What Constitutes Infringement
291k233 Patents for Machines or Manufactures
291k237 k. Substitution of Equivalents. Most Cited Cases
Patent infringement under the doctrine of equivalents may be limited by doctrines of prosecution history estoppel and the all-elements or, more preferably, the all-limitations rule.

[3] Patents 291 ⚿314(5)

291 Patents
291XII Infringement
291XII(C) Suits in Equity
291k314 Hearing
291k314(5) k. Questions of Law or Fact. Most Cited Cases
Whether patent claims are properly supported by the written description is a question of fact.

[4] Patents 291 ⚿314(5)

291 Patents
291XII Infringement
291XII(C) Suits in Equity
291k314 Hearing

291k314(5) k. Questions of Law or Fact. Most Cited Cases
Whether an asserted anticipatory document qualifies as a "printed publication" for purposes of statute governing conditions of patentability is a legal conclusion based on underlying factual determinations. 35 U.S.C.A. § 102.

[5] Patents 291 ⚿237

291 Patents
291XII Infringement
291XII(A) What Constitutes Infringement
291k233 Patents for Machines or Manufactures
291k237 k. Substitution of Equivalents. Most Cited Cases
Assignee of patent directed to subsea wellheads having a horizontal spool tree arrangement that protects the integrity of the well during "workover" activities for repair and maintenance was foreclosed by the all-limitations rule from asserting infringement under the doctrine of equivalents; workover port in accused device entered the wellhead assembly "above" the two plugs, which could not be equivalent to a connection "between the two plugs."

[6] Patents 291 ⚿99

291 Patents
291IV Applications and Proceedings Thereon
291k99 k. Description of Invention in Specification. Most Cited Cases
Patent directed to subsea wellheads having a horizontal spool tree arrangement that protects the integrity of the well during "workover" activities for repair and maintenance was not invalid for failure to meet the written description requirement; drawing disclosed a workover port above the tubing hanger, and fact that the same drawing also showed it between the plugs did not vitiate its disclosure above the tubing hanger. 35 U.S.C.A. § 112.

[7] Federal Civil Procedure 170A ⚿2508

170A Federal Civil Procedure
170AXVII Judgment
170AXVII(C) Summary Judgment
170AXVII(C)2 Particular Cases
170Ak2508 k. Patent Cases. Most Cited Cases
Genuine issue of material fact existed as to whether certain reports were sufficiently available to the public interested in the art at least before the priority date of the patents, if not also before the critical date of those patents, precluding summary judgment in favor of patentee on competitor's claim that reports were "printed publications" under statute governing conditions of patentability. 35 U.S.C.A. § 102.

Patents 291 ⚿328(2)

291 Patents
291XIII Decisions on the Validity, Construction, and Infringement of Particular Patents
291k328 Patents Enumerated
291k328(2) k. Original Utility. Most Cited Cases
5,544,707. Not Infringed.

Patents 291 ⚿328(2)

291 Patents
291XIII Decisions on the Validity, Construction, and Infringement of Particular Patents
291k328 Patents Enumerated
291k328(2) k. Original Utility. Most Cited Cases
6,039,119. Valid.
***1318** John M. Delehanty,Mintz Levin Cohn Ferris Glovsky & Popeo, P.C., of New York, NY, argued for plaintiff-appellant. Of counsel on the brief were William D. Belanger, and Geri L. Haight, Mintz Levin Cohn Ferris Glovsky & Popeo, P.C., of Boston, MA.

Richard L. Stanley, Howrey Simon Arnold & White, LLP, of Houston, TX, argued for defendant-cross appellant. With him on the brief were John F. Lynch, Stephen H. Cagle, John R. Keville, and Ira D. Finkelstein.

Before MAYER, Chief Judge, LOURIE and SCHALL, Circuit Judges.

LOURIE, Circuit Judge.

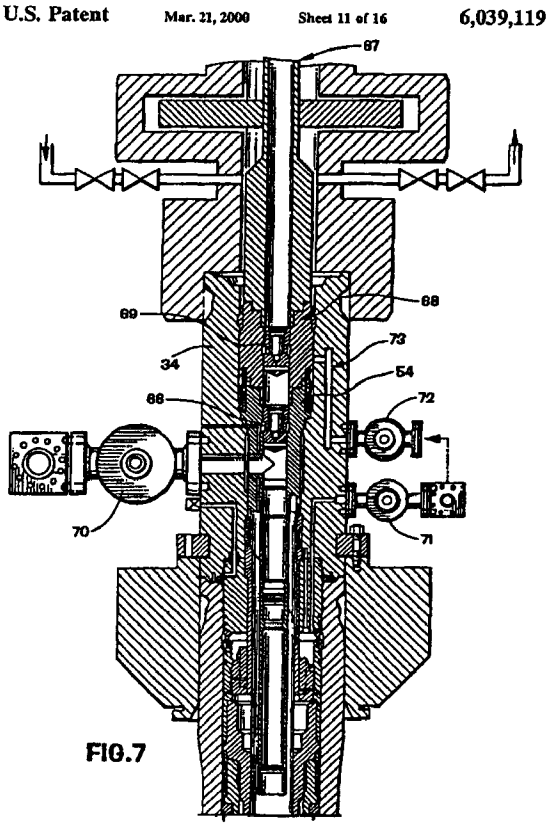
Cooper Cameron Corporation appeals from the decision of the United States District Court for the Southern District of Texas granting Kvaerner Oilfield

Products, Inc.'s motion for summary judgment of noninfringement of claim 10 of Cooper's U.S. Patent 5,544,707 and its motion for summary judgment that the asserted claims of Cooper's U.S. Patent 6,039,119 are invalid for inadequate written description under 35 U.S.C. § 112, ¶ 1. *Cooper Cameron Corp. v. Kvaerner Oilfield Prods., Inc.*, No. H-97-0155, slip op. (S.D.Tex. Apr. 16, 2001) ("*Cooper I*"). Kvaerner cross-appeals from the court's grant of Cooper's motion for summary judgment holding that certain documents did not qualify as "printed publications" under 35 U.S.C. § 102. Because Kvaerner's accused wellhead device does not infringe the '707 patent under the doctrine of equivalents as a matter of law, we affirm on that issue. We conclude, however, that the court erred in its determination that the '119 patent claims are invalid for lack of written description and we therefore reverse the court's grant of summary judgment on that issue. We also reverse the court's grant of summary judgment that the asserted references are not "printed publications" within the meaning of 35 U.S.C. § 102.

BACKGROUND

Cooper is the assignee of the '707 and '119 patents, which are directed to subsea wellheads having a horizontal spool tree ***1319** arrangement that protects the integrity of the well during "workover" activities for repair and maintenance. *Cooper I* at 2. The '707 patent issued first, on August 13, 1996. Claim 10 of that patent recites "[a] wellhead comprising ... a workover port extending laterally through the wall of the spool tree from *between the two plugs*." '707 patent, col. 9, l. 34-col. 10, ll. 4-5 (emphasis added). Cooper amended claim 10 during prosecution by incorporating a number of limitations from other claims. *Cooper I* at 5.

Cooper also filed a continuation application on the wellhead invention, which issued as the '119 patent on March 21, 2000. *Id.* Figure 7 of that patent is reproduced below.



It shows the position of the plugs 66 and 69, as well as the workover port 73 "which extends through the wall of the spool tree to the void between the plugs

69 and 66." '119 patent, col. 7, ll. 2-4. Claim 1 is representative of the different claim scope of that patent and is directed to a wellhead assembly comprising, *inter alia,* "a workover port extending through said wall of said spool tree for selective fluid circulation with that portion of said common passageway *below the BOP bore and above said tubing hanger* ...." *Id.* at col. 8, ll. 19-22 (emphasis added). The "tubing hanger" is denoted as item 54. *Id.* at col. 6, l. 30. Significantly, the workover port is no longer required to be "between the two plugs," as it is in claim 10 of the '707 patent.

Kvaerner manufactures and sells a "Side Valve Tree" device that has a workover port placed above both "plugs," as that term is used in claim 10, but not between the two plugs. *Cooper I* at 4. Cooper sued Kvaerner for infringement of claim 10 of ***1320** the '707 patent under the doctrine of equivalents. *Id.* After the '119 patent issued, Cooper amended its complaint to include an allegation of literal infringement of claims 1, 3, 6, 7, 14, 16, 24, 29, and 31 of that patent.

In its defense, Kvaerner asserted that written reports by Subsea Intervention Systems Ltd. ("SISL") anticipated the claims of both the '707 and '119 patents. Cooper moved for summary judgment that those references were not "printed publications" for purposes of 35 U.S.C. § 102. The court granted that motion, determining that the reports were not generally available or were not prior art. *Cooper Cameron Corp. v. Kvaerner Oilfield Prods., Inc.,* No. H-97-0155, slip op. at 20-23 (S.D.Tex. Feb. 19, 1999) (memorandum opinion and order) ("*Cooper II*").

Kvaerner also moved for summary judgment of noninfringement of the '707 patent, which the court granted. It determined that Cooper was foreclosed from asserting infringement by equivalence due to the amendments it made to claim 10 of the '707 patent during prosecution pursuant to this court's decision in *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.,* 234 F.3d 558, 56 USPQ2d 1865 (Fed.Cir.2000) (en banc), *cert. granted,* 533 U.S. 915, 121 S.Ct. 2519, 150 L.Ed.2d 692 (2001). *Cooper I* at 6, 17. As an alternative basis for its holding, it concluded that the "all-elements" rule foreclosed infringement under the doctrine of equivalents because Kvaerner's accused device had a workover port connecting to the spool tree "above" the two plugs, which could not be "between" the two plugs as a matter of law. *Id.* at 18-19.

Kvaerner additionally moved for partial summary judgment that the asserted claims of the '119 patent are invalid for failure to meet the written description requirement of 35 U.S.C. § 112, ¶ 1. The district court granted this motion, concluding that the claims are not supported by the description in the parent European patent application 92/305,014, filed on June 1, 1992, and thus could not claim the benefit of that filing date. *Cooper I* at 20. The court determined that the original disclosure only referred to the workover port as being located between the two plugs and thus did not support claims having the workover port in a location other than between the two plugs. *Id.* at 23. As Cooper conceded that the challenged claims in the '119 patent would be invalid if they did not relate back to the June 1, 1992 filing date, the court concluded that claims 1, 3, 6, 7, 14, 16, 24, 29, and 31 of that patent were invalid. *Id.* at 24. Cooper timely appealed to this court; we have jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

DISCUSSION

Summary judgment is appropriate "if the pleadings, depositions, answers to interrogatories, and admissions on file, together with the affidavits, if any, show that there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law." Fed.R.Civ.P. 56(c). "The evidence of the nonmovant is to be believed, and all justifiable inferences are to be drawn in his favor." *Anderson v. Liberty Lobby, Inc.,* 477 U.S. 242, 255, 106 S.Ct. 2505, 91 L.Ed.2d 202 (1986). We review a district court's grant of a motion for summary judgment *de novo.* *Ethicon Endo-Surgery, Inc. v. United States Surgical Corp.,* 149 F.3d 1309, 1315, 47 USPQ2d 1272, 1275 (Fed.Cir.1998).

[1][2][3][4] A determination of infringement, whether literal or under the doctrine of equivalents, is a question of fact. *Bai v. L & L Wings, Inc.,* 160 F.3d 1350, 1353, 48 USPQ2d 1674, 1676 (Fed.Cir.1998). Infringement under the doctrine of equivalents***1321** may be limited by two legal doctrines relevant to this appeal: prosecution history estoppel and the "all-elements or, more preferably, the all-limitations rule." *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.,* 520 U.S. 17, 39 n. 8, 117 S.Ct. 1040, 137

L.Ed.2d 146 (1997). Whether claims are properly supported by the written description is a question of fact. *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563, 19 USPQ2d 1111, 1116 (Fed.Cir.1991). Whether an asserted anticipatory document qualifies as a "printed publication" under § 102 is a legal conclusion based on underlying factual determinations. *N. Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 936, 15 USPQ2d 1321, 1325 (Fed.Cir.1990).

On appeal, Cooper argues that *Festo* does not preclude application of the doctrine of equivalents to the '707 patent because it did not amend the "workover port" limitation of claim 10 during prosecution. Similarly, Cooper asserts that the court misapplied the all-limitations rule, arguing that the "workover port" limitation is not vitiated under a proper analysis of the rule because Kvaerner's accused device has a workover port. With respect to the ' 119 patent, Cooper argues that the original disclosure and the drawings describe a workover port that terminates below the BOP bore and above the tubing hanger. In particular, it asserts that the location of the plugs is irrelevant during the workover operation, and thus the "between the two plugs" limitation is not an "essential element" of the invention that must be included in the claims pursuant to this court's decision in *Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 45 USPQ2d 1498 (Fed.Cir.1998).

Kvaerner responds that *Festo* does apply because Cooper amended what became claim 10 by adding limitations to that claim for reasons relating to patentability. Kvaerner also argues that the court properly applied the all-limitations rule to foreclose infringement by equivalents to the "between the two plugs" limitation because "between" expressly excludes "above." Kvaerner also argues that the court properly invalidated the relevant claims of the ' 119 patent because the patent never described the workover port in any location other than between the two plugs.

In the event that we do not affirm the district court on both the infringement and validity issues, Kvaerner cross-appeals from the district court's decision that the SISL documents do not qualify as prior art. Kvaerner argues that it presented genuine issues of material fact that the SISL reports were available to members of the interested public during the relevant time period, and that the business context of the reports indicates that their contents were meant to be disseminated. Cooper responds that distribution of the reports was effectively limited to SISL joint venture members.

A. *Infringement*

[5] We agree with Kvaerner that the district court did not err in granting summary judgment of noninfringement of claim 10 of the '707 patent under the doctrine of equivalents. The Supreme Court in *Warner-Jenkinson* ratified this court's practice of considering that

> [e]ach element contained in a claim is deemed material to defining the scope of the patented invention, and thus the doctrine of equivalents must be applied to individual elements of the claim, not to the invention as a whole. It is important to ensure that the application of the doctrine, even as to an individual element, is not allowed such broad play as to effectively eliminate that element in its entirety.

520 U.S. at 29, 117 S.Ct. 1040. More recently, in *Moore U.S.A., Inc. v. Standard Register Co.*, 229 F.3d 1091, 1094, 56 USPQ2d 1225, 1235-36 (Fed.Cir.2000), we ***1322** held that a claim to a mailing form requiring that strips of adhesive extend to "the majority" of the lengths of longitudinal margin portions could not be met equivalently by an accused device with strips of adhesive that extended to only 47.8% of the length of the margin because a "minority" could not be a "majority" as a matter of law. Similarly, the workover port in Kvaerner's accused device enters the wellhead assembly "above" the two plugs, which cannot be equivalent to a connection "between the two plugs." Were we to ignore Cooper's decision to claim in the '707 patent a workover port that connects to the assembly only "between" the plugs, we would vitiate that limitation and thereby run afoul of the all-limitations rule. Moreover, we are not persuaded by Cooper's arguments that the court should have defined the relevant limitation for purposes of the all-limitations rule as the "workover port," which is in fact present in Kvaerner's device, although admittedly not at the claimed location between the two plugs. Cooper cannot escape application of the all-limitations rule by recharacterizing its claim so as to ignore a material limitation. We therefore conclude that the district court properly granted

summary judgment of noninfringement. We need not review the district court's alternative basis for that judgment, *viz.,* prosecution history estoppel under *Festo.*

B. *Invalidity under 35 U.S.C. § 112, ¶ 1*

[6] We agree with Cooper, however, that the district court erred in granting summary judgment that the asserted claims of the '119 patent are invalid for failure to meet the written description requirement. In *Vas-Cath,* we held that "under proper circumstances, drawings alone may provide a 'written description' of an invention as required by § 112." 935 F.2d at 1565, 19 USPQ2d at 1118. Drawings constitute an adequate description if they describe what is claimed and convey to those of skill in the art that the patentee actually invented what is claimed. *Id.* at 1566, 935 F.2d 1555, 19 USPQ2d at 1119. In *Vas-Cath,* we reversed the district court's grant of summary judgment of invalidity of claims to a double lumen catheter having a combination of features. In particular, we disagreed with the court's statement that one could not tell from the drawings what combination of the disclosed features constituted "the invention" because "[t]hat combination invention is what the [patent's] drawings show." *Id.* at 1565, 935 F.2d 1555, 19 USPQ2d at 1118. The court's concern with "what the invention is" was misplaced, we explained, because there is no "legally recognizable or protected 'essential' element, 'gist' or 'heart' of the invention in a combination patent." *Id.* (quoting *Aro Mfg. Co. v. Convertible Top Replacement Co.,* 365 U.S. 336, 345, 81 S.Ct. 599, 5 L.Ed.2d 592 (1961)).

Similarly, the '119 patent, which the parties agree shares an identical written description with the '707 patent and the original European patent application from which priority is claimed, depicts a wellhead assembly having a workover port 73 entering the assembly at the location claimed, *viz.,* above the tubing hanger 54 and below the BOP bore at the top of the figure. *See, e.g.,* '119 patent, Figure 7. As in *Vas-Cath,* the invention shown in the drawing is the invention claimed. Although the specification also describes an arrangement that may be claimed in another way (*i.e.,* "between the plugs"), and explains why the invention functions well when arranged accordingly, the specification is not limited to that particular description. An inventor is entitled to claim his invention in more than one way. Cooper's expert explained that the statement that the "workover port extends laterally through the wall of the spool tree from between the two plugs," '119 patent, col. 4, ll. 11-13, "clearly teaches that the important***1323** feature is that the workover port extends laterally through the wall above the lower plug which is in the top of the tubing hanger." Examination of Figure 7 shows that it clearly provides a written description of the arrangement as it is depicted and claimed in the '119 patent. No reasonable fact-finder could conclude otherwise.

We are not persuaded by Kvaerner's arguments, relying on *Gentry,* that it is essential to the invention for the workover port to enter the assembly "between the two plugs" and that claims reciting a location other than "between the two plugs" are therefore invalid for inadequate description. In *Gentry,* the original disclosure identified the console of a sectional sofa as the only possible location for the controls. 134 F.3d at 1479, 45 USPQ2d at 1503. We held that the asserted claims were invalid because the location of the recliner controls in the claims was not limited to the console. *Id.* at 1479-80, 45 USPQ2d at 1503-04. In reaching that conclusion, we stated: "[I]t is clear that [the inventor] considered the location of the recliner controls on the console to be an essential element of his invention. Accordingly, his original disclosure serves to limit the permissible breadth of his after-drafted claims." *Id.* In so stating, we did not announce a new "essential element" test mandating an inquiry into what an inventor considers to be essential to his invention and requiring that the claims incorporate those elements. Use of particular language explaining a decision does not necessarily create a new legal test. Rather, in *Gentry,* we applied and merely expounded upon the unremarkable proposition that a broad claim is invalid when the entirety of the specification clearly indicates that the invention is of a much narrower scope. *Id.* ("[C]laims may be no broader than the supporting disclosure."). There was no description or support whatever in the *Gentry* patent of the controls being other than on the console. In contrast, in this case, Cooper's claims to the location of the workover port in the '119 patent are supported by the figures showing that the workover port is in fact above the tubing hanger and below the BOP bore. *See, e.g.,* '119 patent, Figure 7.

We are also not persuaded by Kvaerner's arguments that the claims are invalid for inadequate description

because the specification does not indicate that the workover port may be claimed by reference to the position of the tubing hanger and BOP bore. The drawing does disclose a workover port above the tubing hanger. The fact that the same drawing also shows it between the plugs does not vitiate its disclosure above the tubing hanger. Both descriptions are supported by the same drawing. Because no reasonable fact-finder could find that Kvaerner demonstrated the invalidity of the '119 claims by clear and convincing evidence, we reverse the court's grant of summary judgment and conclude that the claims are not invalid for inadequate description as a matter of law.

C. *Printed Publications*

[7] We agree with Kvaerner that the court erred in granting summary judgment that the four SISL reports are not "printed publications" under § 102 because Kvaerner raised a genuine issue of material fact that the reports were sufficiently available to the public interested in the art at least before the priority date of the '707 and '119 patents (June 1, 1992), if not also before the critical date of those patents (June 1, 1991). The SISL joint venture released the Task 1000 and 2000 reports to its three members and six participants between late 1990 and the end of June 1992. Kvaerner submitted employee affidavits stating that those papers were not considered confidential and were distributed to interested parties, including outside contractors. SISL also submitted a second interim report to the Commission of European***1324** Communities in July 1991. The court thus improperly resolved questions of fact in Cooper's favor when it determined that the second report had not been distributed to SISL participants. Moreover, we disagree with the court's conclusion that the "confidential" label on that report removed it as an available prior art reference. As Kvaerner points out, the report contained only a single confidentiality notice relating to financial information on the fourth page of its 130 pages. That notice does not render the entire document inaccessible in light of evidence that the reports were available to participants who were allowed to share confidential data with others. These documents are therefore unlike those held not to qualify as prior art in *Northern Telecom,* as the documents in that case were not authorized for public release and were maintained under a policy of restricted access. *N. Telecom,* 908 F.2d at 936, 15 USPQ2d at 1325.

With respect to the final report bearing a date of March 1992, the district court also improperly resolved questions of fact in Cooper's favor in its determination that the report was not available until after June 29, 1992. The presence of the earlier date on the report indicates that it may have been available as of that date and would thus qualify as prior art under § 102(a).

Finally, on remand the district court should take into consideration that reports need only be accessible to the interested public, *Mass. Inst. of Tech. v. AB Fortia,* 774 F.2d 1104, 1109, 227 USPQ 428, 432 (Fed.Cir.1985), which in this case may be the very entities who had access to the documents: SISL joint venture members, participants, and their contractors and licensees. This does not appear to be a case in which documents shared with joint venture members are maintained in confidence. Here, those with access to the documents were asserted to be a significant portion of the interested public. Moreover, Kvaerner presented evidence that any other interested persons exercising reasonable diligence could have sought information concerning horizontal tree subsea well designs from SISL, much if not all of which information was available without restriction. However, those are matters the district court should resolve on remand.

Because we conclude that Cooper is foreclosed by the all-limitations rule from asserting infringement under the doctrine of equivalents, we affirm the court's grant of summary judgment of noninfringement of claim 10 of the ' 707 patent. However, the court erred in granting summary judgment on Kvaerner's motion that the asserted '119 claims are invalid for inadequate description and in granting Cooper's motion that the SISL reports do not qualify as prior art with respect to both the '707 and '119 patents. Accordingly, we

AFFIRM-IN-PART and *REVERSE-IN-PART.*

C.A.Fed. (Tex.),2002.
Cooper Cameron Corp. v. Kvaerner Oilfield Products, Inc.
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Date of Deposit: 02-17-2005 By: Terrie Lindquist
Terrie Lindquist

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Applicant:		§	
		§	
	GLOVER, JOHN N.	§	
		§	
Filed:	May 27, 1999	§	Art Unit: 1723
		§	
Application No.:	09/320,950	§	Examiner: David L. Sorkin
		§	
For: FILTERING MEDIUM AND METHOD FOR CONTACTING SOLIDS CONTAINING FEEDS FOR CHEMICAL REACTORS		§	Docket No.: 20781.004

AMENDMENT AND RESPONSE

Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Dear Sir:

In response to the Office Action dated August 17, 2004, Applicant files the following Amendment and Response. Reconsideration of this application is respectfully requested. A Request for Extension of Time and accompanying check for $510.00 is also enclosed herewith.

The Commissioner is hereby authorized to charge any additional fees that may be required or credit any overpayment to Bracewell & Patterson, L.L.P. Deposit Account No. 50-0259 (Order No. 020781.004).

IN THE CLAIMS

Please amend the claims without prejudice, as follows:

Claims 1-58. CANCELED

Claim 59. (Previously Presented) A method of fluid distribution in a chemical reactor comprising the steps of:

providing a layer of a plurality of ceramic filter units, at least some of the ceramic filter units including a body having a substantially annular outer peripheral shape, a central opening extending through the body, and at least three elliptical openings extending through the body and positioned between the central opening and an outer periphery of the body so that a combination of the central opening and the at least three elliptical openings define a plurality of fluid flow passageways extending through the at least some of the plurality of ceramic filter units;

contacting an organic-based feed stream with the layer of the plurality of ceramic filter units; and

subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through the plurality of fluid flow passageways prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Claim 60. CANCELED

Claim 61. (Previously Presented) A method as defined in claim 59, further including the steps of: removing contaminants from a contaminated organic-based feed stream; and providing a decontaminated and uniformly spread organic-based feed stream to a catalyst bed for further processing in the chemical reactor.

Claim 62. (Previously Presented) A method as defined in claim 59, including the step of packing the ceramic filter units into the chemical reactor with a packing factor of about 200 to 500 ft^2/ft^3.

Claim 63. (Previously Presented) A method as defined in claim 59, including the step of packing the ceramic filter units in graduated layers into the chemical reactor with each layer having a different packing factor of about 200 to 500 ft^2/ft^3.

Claim 64. (Previously Presented) A method as defined in claim 59, wherein the body of at least one of the plurality of ceramic filter units has a fluted outer peripheral surface.

Claim 65. (Previously Presented) A method as defined in claim 59, wherein the outer peripheral includes a plurality of recessed notches extending inwardly from the outer periphery towards the medial portion of the ceramic filter unit.

Claim 66. (Previously Presented) A method as defined in claim 59, wherein the at least three elliptical openings substantially surround the central opening between the central opening and the outer periphery to thereby define a ring around the central opening.

Claim 67. (Previously Presented) A method of fluid distribution in a chemical reactor comprising the steps of:

providing a layer of a plurality of ceramic filter units, at least some of the ceramic filter units including a body having a substantially polygonal outer peripheral shape, a central opening extending through the body, and at least three elliptical openings extending through the body and positioned between the central opening and an outer periphery of the body so that a combination of the central opening and the at least three

elliptical openings define a plurality of fluid flow passageways extending through the at least some of the plurality of ceramic filter units;

contacting an organic-based feed stream with the layer of the plurality of ceramic filter units; and

subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through at least some of the plurality of fluid flow passageways prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Claim 68. CANCELED

Claim 69. (Previously Presented) A method as defined in claim 67, further including the steps of: removing contaminants from a contaminated organic-based feed stream; and providing a decontaminated and uniformly spread organic-based feed stream to a catalyst bed for further processing in the chemical reactor.

Claim 70. (Previously Presented) A method as defined in claim 67, wherein the outer peripheral includes a plurality of notches recessed from the outer peripheral towards the medial portion of the ceramic filter unit.

Claim 71. (Previously Presented) A method as defined in claim 67, including a step of utilizing ceramic filter units wherein the outer periphery has a polygonal shape with a length of about 1/8 inches to about 3 inches.

Claim 72. (Previously Presented) A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a substantially polygonal shape selected from the group consisting of triangles, quadrilaterals, squares, rectangles, pentagons, hexagons, heptagons, and octagons.

Claim 73. (Previously Presented) A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a square shape with a width of about ¼ inches to about 3 inches.

Claim 74. (Previously Presented) A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a rectangular shape with a length of about ¼ inches to about 3 inches and a width of about ¼ inches to about 3 inches.

Claim 75. (Previously Presented) A method as defined in claim 67, wherein the body of at least one of the plurality of ceramic filter units has a closed-planed shape with a width of about ¼ inches to about 3 inches.

Claim 76. (Previously Presented) A method as defined in claim 67, wherein the outer peripheral includes a plurality of recessed notches extending inwardly from the outer periphery towards the medial portion of the ceramic filter unit.

Claim 77. (Previously Presented) A method as defined in claim 67, wherein the at least three elliptical openings substantially surround the central opening between the central opening and the outer periphery to thereby define a ring around the central opening.

Claim 78. (Previously Presented) A method of fluid distribution in a chemical reactor comprising the steps of:

providing a layer of a plurality of ceramic filter units, at least some of the ceramic filter units including a body, a central opening extending through the body, and at least three elliptical openings also extending through the body and positioned between the central opening and an outer periphery of the body so that a combination of the central opening and the at least three elliptical openings define a plurality of fluid flow passageways extending through each of the plurality of ceramic filter units;

contacting an organic-based feed stream with the layer of the plurality of ceramic filter units; and

subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through the at least some of the plurality of fluid flow passageways prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Claim 79. (Previously Presented) A method as defined in Claim 59, wherein the central opening is circular.

Claim 80. (Previously Presented) A method as defined in Claim 67, wherein the central opening is circular.

Claim 81. (Previously Presented) A method as defined in Claim 78, wherein the central opening is circular.

Claim 82. (New) A method as defined in Claim 64, wherein the fluted outer peripheral surface of the at least one of the plurality of ceramic filter units has sharp edges.

Claim 83. (New) A method as defined in Claim 65, wherein at least one of the recessed notches of the outer periphery has sharp edges.

Claim 84. (New) A method as defined in Claim 70, wherein at least one of the notches recessed from the outer periphery has sharp edges.

Claim 85. (New) A method as defined in Claim 76, wherein at least one of the recessed notches on the outer periphery has sharp edges.

REMARKS

35 U.S.C. §103(a) Rejection – Kramer in view of Fulton:

Claims 59, 61 – 67, and 69 – 81 were rejected under the provisions of 35 U.S.C. § 103(a), as allegedly being unpatentable over Kramer (US 4,615,796) in view of "CE Refresher: Catalyst Engineering, Part 2" by John Fulton (hereinafter "Fulton").

The Examiner indicated that Kramer discloses a method of fluid distribution in a chemical reactor comprising the steps of providing a layer of a plurality of ceramic filter units, contacting an organic-based stream with the layer of the plurality of ceramic filter units, and passing the organic-based stream through the layer prior to the organic-based feed stream contacting a catalyst bed in the chemical reactor.

Response to § 103(a) Rejection:

It is submitted that the combination of Kramer and Fulton does not show, teach or make obvious the subject matter of the claims as presented herein.

In particular, independent claim 67 of the present invention describes a ceramic filter unit with a body having a substantially polygonal outer peripheral shape. Examples of polygonal shapes include triangles (FIG. 6), quadrilaterals (FIG. 7), pentagons (FIG. 8), hexagons (FIG. 9), heptagons (FIG. 10), octagons (FIG. 11) and squares (FIG. 13). Further, dependent claim 64 describes a ceramic filter unit with a fluted outer peripheral surface (FIG. 5), and dependent

claims 65, 70 and 76 describe ceramic filter units with outer peripheries having a plurality of recessed notches. (FIG. 16).

A common feature of these polygonal shaped units and units with fluted surfaces or recessed notches of the present invention is that they each have sharp corners or edges on the outer peripheries of the unit surface. Newly added claims 82-85 specifically recite this feature of sharp edges. This feature is shown in the present application in the filter units of FIGS. 5-11, 13 and 16.

Fulton teaches, however, that sharp corners are a disadvantageous feature and should be "eliminated" as a potential shape option. (see page 97, ¶ 3). Fulton teaches that sharp corners would crumble in service, and the resulting dust and fragments would plug the bed spaces between pellets and cause premature buildup in bed pressure drop. (see page 97, ¶ 3).

Thus, Fulton teaches away from the use of sharp corners or edges on the outer peripheries of supported catalyst. Applicant respectfully submits that it would not be obvious to one skilled in the art to utilize the sharply cornered shapes shown in Figure 1 of Fulton in the design of the ceramic filter units shown in Kramer, as there is no suggestion or motivation to combine the references. As such, Applicant respectfully submits that its present claims 64, 65 and 67 and their dependent claims, as well as newly added claims 82 - 85, relating to this particular feature are nonobvious and patentably distinct.

In addition to the arguments presented above, Applicant maintains and resubmits the following arguments, which were previously presented in similar, but not identical, form in Applicant's office action response dated November 5, 2003.

Fluid Distribution is Not Filtering

Applicant respectfully submits that Kramer does not disclose a method of *fluid distribution*, but rather a method of *filtering*. As described in col. 3, lines 8 – 15, Kramer teaches the removal of suspended solids, preferably iron sulfide, of greater than 10 microns in diameter from mixed phase gas-liquid-solid streams. Kramer is tailored to correcting a specific problem in the petroleum processing industry, namely removal of materials similar to iron sulfide. No

mention is made in the Kramer disclosure of fluid distribution. Fluid distribution is not the same or equivalent to filtering.

Applicant also respectfully submits that Kramer also does not disclose the step of "subdividing the organic-based feed stream into a plurality of smaller fluid streams by passing the organic-based feed stream through the plurality of fluid flow passageways". An embodiment of Applicant's invention involves the use of ceramic filter units with openings, wherein the particular fluid in the reactor may not only pass around a unit in the layer, but also through at least some of the ceramic filter units by using the plurality of fluid flow passageways created by the openings in at least some of the ceramic filter units.

Shapes of the Units

Although Kramer does explain that alternative shaped units can be used (col. 4, lines 1 – 4), with spheres being the preferred shape, there is no suggestion that a ceramic filter unit with openings, specifically three or more passages surrounding a central passage, can be used. Applicant's claims 59, 67, and 78 require that the surrounding openings have an elliptical shape. Kramer repeatedly indicated that a sphere was the unit of choice. Every example given in Kramer illustrated the use of a sphere without any openings. More specifically, Examples 1, 2, and 3 in Kramer exclusively uses spheres as the filtering medium.

An important aspect of an embodiment of the present invention is to uniformly distribute the organic-based feed stream across a catalyst bed to prevent channeling and other deleterious consequences by passing the stream through openings in the units. The spherical units disclosed within Kramer would not provide the required flow through at least some of the units.

Declaration of Inventor

Applicant's use of the ceramic units of the present invention unexpectedly results in advantageous fluid distribution properties, such as improved horizontal fluid distribution and significantly decreased pressure drop across a filter bed. To support these assertions, Applicant has submitted the attached declaration of John N. Glover (hereinafter referred to as the "Declaration"). Mr. Glover has substantial experience in the ceramic and catalyst industries and has participated in experiments resulting in unexpected and surprising, advantageous fluid distribution properties. The Declaration also provides evidence of the commercial success of these ceramic units, which is indicative of the fact that the claimed ceramic filter units of the present invention should be deemed to have met a long felt, unfilled need in the petroleum refining and petrochemical industries. Applicant has performed experiments comparing the ceramic filter units of the present invention with prior art ceramic units that are structurally similar to ceramic units, such as those found in Fulton and Kramer.

It should be noted that according to the Applicant, to the best of his knowledge, the Fulton Ceramic Unit was not commercially available at the time of the experiments and thus

could not be tested. (see page 2, ¶ 7). A similar commercially available unit ("Product C") was instead utilized. *Id.*

Several measurements were taken during the experiments to help determine the amount of lateral fluid distribution that was achieved using several different ceramic units. Table I summarizes the results of each experiment. The best results are indicated by boxed numbers. Five prior art ceramic units (Products A, B, C, D, and E) were compared to three ceramic units made in accordance with the present invention (Products F, G, and H). The prior art ceramic unit results are shaded in gray in Table I and the results for the ceramic units made in accordance with the present invention are non-shaded and located on the right side of Table I. Descriptions of the Products tested can be found in Paragraphs 5 – 10 of the Declaration and in Table I in row labeled as "Product". Samples of the two best performing prior art ceramic units, Products C and E, were included in Applicant's response dated November 5, 2003. Samples of the two best performing ceramic units made in accordance with the present invention, Products F and H, were also included in Applicant's above indicated response.

A detailed description of the experiments that were performed and the apparatus is included in the Declaration in paragraphs 11 – 23. The ceramic units of the present invention performed significantly better than the prior art units similar to those shown in Fulton and Kramer. The experiments showed that there was a substantial increase in the lateral distribution using the ceramic units of the present invention as opposed to the ceramic units with the shapes similar to those shown in Fulton and Kramer.

As described in paragraphs 24 – 25 of the Declaration appended hereto, the ceramic units made in accordance with the present invention performed significantly better than the prior art ceramic units consistently through each experiment that was performed. The experiments illustrate the unexpected results obtained by using the present invention as opposed to the prior art ceramic units. The ceramic units made in the accordance with the present invention provided more lateral distribution for fluid than the prior art ceramic units did.

Claims 59, 66 – 67, and 77 – 78 recite the use of elliptical openings. Support in the specification for the amendments can be found in FIGS. 4, 5, and 12 of the specification. Neither

of the references taken alone or in combination with each other describe a ceramic unit with a central opening and three or more elliptical openings.

Use of elliptical openings also provides an additional design parameter to specify when designing the ceramic units to maximize the amount of material that is allowed to pass through the body of the ceramic unit. For instance, when a circular shape is used for the surrounding openings, as in the Fulton Ceramic Unit, the design parameters that can be changed include the unit diameter, the unit length, the central opening diameter, the number of outer openings, the location of the center of the outer openings, and the diameters of the outer openings. If elliptical outer openings are used, the design parameters that can be changed include the unit diameter, the unit length, the central opening diameter, the number of outer openings, the location of the center of the outer openings, the major axis of the elliptical openings, and the minor axis of the elliptical openings. Using elliptical openings, along with the central opening, provides better control of the amount of fluid distribution and filtering provided by the ceramic units. This allows manufacturers to better customize the ceramics for each application. If more lateral distribution is required in a particular application, then the manufacturers have an additional parameter to optimize to improve lateral distribution.

In addition to the unexpected results obtained by the ceramic units of the present invention, the Assignee of Applicant has enjoyed substantial commercial success from the sale of the ceramic units of the present invention, as described in Paragraph 26 of the appended Declaration. In the period from 1998 to the execution of the Declaration in 2003, Applicant's Assignee sold more than eight million dollars worth of ceramic units, which correlates to approximately 40,000 cubic feet of unit sold. At the time, the ceramic units of the present invention were the number two selling ceramic units with approximately 30% - 35% of the market. The commercial success of the ceramic units made in accordance with the present invention should be considered indicative of the fact that the ceramic units have met a long felt, unfilled need in the ceramic filter industry.

As indicated previously, neither Kramer nor the combination of Kramer and Fulton disclose the present invention. The Federal Circuit noted in *In re Fritch* that:

> Under Section 103, teachings of references can be combined only if there is some suggestion or incentive to do so. Although couched in terms of combining teachings found in the prior art, the same inquiry must be carried out in the context of a purported obvious "modification" of the prior art. The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. 23 U.S.P.Q. 2d 1780, 1784 (Fed. Cir. 1992).

Neither Kramer nor any of the other prior art cited suggest the desirability of combining Kramer with Fulton to accomplish Applicant's invention. Even if these references were combined, they would not disclose each element of claims 59, 67, or 78.

Applicant respectfully submits that neither Kramer nor the combination of Kramer and Fulton teaches each required element of claims 59, 67, and 78. There is no suggestion to combine the references, and even if there were, the combination does not disclose the present invention. Applicant respectfully submits that the basis for the 35 U.S.C. § 103(a) rejections has been removed.

As the independent claims are directed to novel subject matter, dependent claims are by definition also direct to novel subject matter and include all of the distinct elements of the independent claims. Applicant submits that claims 59, 67, and 78 are patentably distinguishable from Kramer in view of Fulton, thereby removing any basis for the 35 U.S.C. § 103(a) rejection.

35 U.S.C. §103(a) Rejection – Kramer in view of Fulton and Hung

Claims 59, 61-67 and 69-81 were rejected under the provisions of 35 U.S.C. § 103(a), as allegedly being unpatentable over Kramer in view of Fulton, and further in view of Hung et al. (DE 3,539,195).

Applicant submits that neither Kramer alone or in combination with Fulton, if such combination was deemed proper, teach all of the features of the present claims. By combining Kramer with Fulton and Hung, if such combination was deemed proper, the combination of the three references would still not disclose the present invention. Hung, which has a catalyst with openings that can be elliptical or circular, does not disclose the use of a central opening, as described herein. Thus, neither Kramer, nor the combination of Kramer with Fulton or Kramer with Fulton and Hung disclose each feature of the present invention. As such, the references,

alone or in combination, do not disclose the present invention, which makes the present invention patentably distinguishable from the ceramic units of the cited references.

SUMMARY

Kramer is missing at least one element of the present invention. No motivation exists to combine Kramer with Fulton or Kramer with Fulton and Hung. Even if the combination of the references were deemed proper, the combination does not disclose each element of the present invention.

In commenting upon the references and in order to facilitate a better understanding of the differences that are expressed in the claims, certain details of distinction between the references and the present invention have been mentioned, even though such differences do not appear in all of the claims. It is not intended by mentioning any such unclaimed distinctions to create any implied limitations in the claims. Not all of the distinctions between the prior art and Applicant's present invention have been made by Applicant. For the foregoing reasons, Applicant reserves the right to submit additional evidence showing the distinctions between Applicant's invention to be novel and nonobvious in view of the prior art.

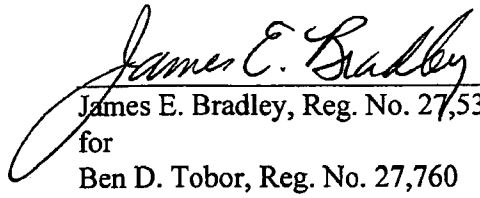
The foregoing remarks are intended to assist the Examiner in examining the application and in the course of explanation may employ shortened or more specific or variant descriptions of some of the claim language. Such descriptions are not intended to limit the scope of the claims; the actual claim language should be considered in each case. Furthermore, the remarks are not to be considered to be exhaustive of the facets of the invention that render it patentable, being only examples of certain advantageous features and differences which Applicant's attorney chooses to mention at this time.

In view of the foregoing Amendment, Applicant respectfully submits that the presently presented claims are allowable, and Applicant respectfully requests the issuance of a Notice of Allowance.

The Commissioner is hereby authorized to charge all fees and any additional fees that may be required or credit any overpayment to Bracewell & Patterson, L.L.P. Deposit Account No. 50-0259 (Order No. 020781.004).

Respectfully submitted,

Date: February 17, 2005



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I

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Applicant:	§	
	§	
GLOVER, JOHN N.	§	
	§	
Filed: May 27, 1999	§	Art Unit: 1723
	§	
Application No.: 09/320,950	§	Examiner: David L. Sorkin
	§	
For: FILTERING MEDIUM AND METHOD FOR CONTACTING SOLIDS CONTAINING FEEDS FOR CHEMICAL REACTORS	§	Docket No.: 20781.004

DECLARATION OF JOHN N. GLOVER

I, John N. Glover, declare that I am over the age of twenty-one (21) years of age and am fully competent to make this declaration. I have personal knowledge of the facts set forth in this declaration and they are true and correct. I declare:

1. I am the President of Crystaphase International, Inc. and its related corporate entities (hereinafter "Crystaphase"), and maintain an office at Crystaphase at 16825 Northchase Drive, Suite 660, Houston, TX. 77060-6029. I have been employed by Crystaphase since 1989 to the present as the President. I am the name inventor in the above-identified patent application and am familiar with the disclosure in the above-identified patent application.

2. I have worked in the petroleum refining and petrochemical industries for at least twenty-four years. I am familiar with ceramic filter units, catalysts, and recycling of these units.

3. I am a named inventor of the subject application and thus would be considered of above-ordinary skill in the art of ceramic filter units and associated methods. In my position of President, I have supervised numerous individuals and therefore am knowledgeable about the level of understanding of one with ordinary skill in the art in the field of ceramic filter units.

4. My educational experience includes undergraduate studies in Biology and Chemistry. I have performed numerous experiments on the subject matter of the above referenced patent application. I am extremely familiar with terms in the industry and the understanding associated with those terms throughout the industry.

5. I participated in an experiment in which comparative performance data was obtained for ceramic filter units comparing ceramic units in accordance with the present invention having combinations of elliptical and circular openings, along with flutes, to ceramic units in accordance with prior art units having combinations of circular openings and flutes. Five prior art ceramic units (Products A, B, C, D, and E) were compared to three ceramic units made in accordance with the present invention (Products F, G, and H, as shown in FIG. 4 of the present application).

6. Products A and B were spherical ceramic balls made in accordance with the ceramic units in U.S. Patent No. 4,615,796 issued to Kramer (hereinafter "Kramer"), with Product A having a 6" bed and Product B having a 12" bed.

7. Product C was a 5/8" disc with six circular openings and one central circular opening that is substantially similar to the closest prior art in "CE Refresher: Catalyst Engineering, Part 2" by John Fulton (hereinafter "Fulton") as shown at Fig. 1, third column, fifth row (hereinafter "Fulton Ceramic Unit"). A sample of Product C has been included and is labeled as C. Product C is manufactured by Haldor Topsoe A/S and is commercially available as TK-10. TK-10 has been on the market for approximately seventeen years and is the number one selling ceramic unit. Product C (i.e., TK-10) is the closest commercially available ceramic unit structurally to the Fulton Ceramic Unit. Product D is a 7/8" disc with six circular openings and one central circular opening. Product D is substantially similar to Product C, but with a larger diameter. To the best of my knowledge, the Fulton Ceramic Unit is not commercially available.

8. Product E is a 5/8" ceramic unit with one central circular opening and six flutes. Product E is commercially available as Dypor 607 and is manufactured by Dytech Corporation, Ltd. in Sheffield, England. A sample of Product E has been included and is labeled as E.

9. Product F is a 5/8" ceramic unit with one central circular opening and four surrounding elliptical openings made in accordance with the present invention. A sample of Product F has been included and is labeled as F. Product G is a 7/8" disc with one central circular opening and four surrounding elliptical openings, also made in accordance with the present

invention. Products F and G are commercially available as BG-1000 and are sold by the Assignee of the present invention.

10. Product H is a 7/8" elongated disc with one central circular opening and four surrounding elliptical openings made in accordance with the present invention. Product H is commercially available as BG-1002 and is sold by the Assignee of the present invention. A sample of Product H has been included and is labeled as H. Product H is twice as long as Product G.

11. A test apparatus was constructed using a 12" internal diameter by 18" tall 26 gauge steel cylinder with a collection grid inside the cylinder, as shown in FIG. 1 attached hereto. The collection grid was constructed of ½" thick grating on top of a solid plate, which was placed in the bottom of the cylinder as a collector floor, as shown in FIG. 3 attached hereto. The plate was drilled with 253 holes through the cells of the grating, each having a ¼" diameter. Each one of the holes was centered in the collection grid with 0.65" centers, which created collection squares or cells, as shown in FIG. 3 attached hereto. The collection grid was secured to the floor using a silicon sealer.

12. Clear plastic tubes were pressed into each hole from below until the tubes extended approximately 1/16" above the top of the plate. A watertight seal was formed around each of the tubes. A clear plastic baffle was drilled to match the holes in the collector floor and installed ½" above the end of the 8" plastic tubes, as shown in FIG. 2 attached hereto. Both the collector and the lower portion of the plastic tubes were marked to accurately identify each individual tube during experimenting.

13. A single flow-regulated water inlet was installed so that the inlet could be accurately centered and placed six inches above the top of the bed to be tested. A six inch headspace is commonly used in trickle bed reactors into which the present invention is commonly installed. The water flow rate used in the experiments was one liter per minute.

14. The flow device and the steel cylinder/collector assembly were mounted on a seven foot tall stand. The fluid flow collection was at eye-level, where it could be easily observed.

15. A 1,000 mL graduated cylinder was used to collect and measure the flow through a single tube. A tight fitting funnel was placed over the cylinder to ensure that no water would enter other than through the single plastic tube. The funnel was slip-fitted over each collector tube one at a time. A digital timer was used for timing.

16. Several measurements were taken during the experiments to help determine the amount of lateral fluid distribution that was achieved using several different ceramic units. Table I summarizes the results of each experiment. The prior art ceramic unit results are shaded in gray in Table I and the results for the ceramic units made in accordance with the present invention are non-shaded and located on the right side of Table I.

17. The first measurement that was used to compare the lateral fluid distribution caused by the ceramic units was a determination of the number of cells that had liquid flow present within the collection grid. The larger the number of cells with flow, or active cells, indicates better lateral distribution because the feed stream is distributed across a larger area containing cells. The lower the flow rate within each cell also indicates better lateral distribution due to the dividing of the feed stream by the cells that distributes the feed stream better laterally. The results of this experiment are shown in Table I in the row labeled as "1. Total Number of Active Cells" and "2. % of Active Cells." The percentage of active cells is calculated by dividing the number of active cells by the total number of cells, 253. The best performing prior art ceramic unit was Product E. The best performing ceramic unit made in accordance with the present invention was Product F. Product F had 11% more active cells than the best performing prior art ceramic unit in this experiment, which represents a 46% improvement over the prior art.

18. The next experiment that was conducted determined an active area of the grid in which flow was determined and is labeled as the row "3. Area of Active Cells". The larger the Area of Active Cells, the better. The larger Area of Active Cells indicates better lateral distribution than a smaller Area of Active Cells. The Area of Active Cells was calculated by multiplying the horizontal distance of the active cells by the vertical distance of the active cells. Not every cell within the Area of Active Cells has flow. The ceramic unit made in accordance with the present invention labeled in Table I as Product F performed the best with the greatest Area of Active Cells being 180. The prior art ceramic unit labeled as Product C in

Table I performed the best with 143 active cells. It is believed that Product C would perform better than the Fulton Ceramic Unit because Product C has more openings than the Fulton Ceramic Unit. Product F made in accordance with the present invention performed approximately 26% better than the prior art Product C in this experiment.

19. Measurements were taken to determine the distance the flow was laterally distributed based upon the feed location. Product H, which is made in accordance with the present invention, performed the best compared to any of the tested ceramic units, with a total of ten cells with flow located greater than five cells away from the central feed location and three cells with flow located greater than six cells away from the central feed location. Out of the prior art ceramic units that were tested, the best performance was obtained by using Product C. Product C only had two cells with flow located greater than five cells away from the central feed location. No cells greater than six cells away from the central feed location had any flow in them in the prior art ceramic units. Product H performed at least five times better than Product C when determining the number of active cells greater than five cells away from the feed stream location. Product H performed at least three times better than Product C when determining the number of active cells greater than six cells away from the feed stream location.

20. Measurements were also taken of the flow rates within each cell. A lower flow rate is indicative of better lateral distribution, since the flow is distributed across a larger number of cells. The present invention embodiments with one central opening and surrounding elliptical openings consistently outperformed the prior art units tested.

21. The average flow rate per active cell was determined for each active cell. To determine this average flow rate, the total inlet feed flow rate was divided by the number of active cells. The lower the average flow rate, the better. A lower average flow rate per active cell indicates that the feed stream was distributed among a greater number of active cells. Product F performed the best with only 1.16% average of the flow rate. With respect to the prior art ceramic units, Product E performed the best with 1.69% average of the flow rate. The prior art with the closest structural similarity to the Fulton Ceramic Unit, Product C, had a 1.72% average of the flow rate. The present invention performed approximately 30% better than the best performing prior art ceramic units tested.

22. The maximum flow rate in a cell was also measured for all of the tested ceramic units. The maximum flow in a cell was determined by measuring the flow rates of each active cell and determining the highest flow rate of those cells. In this experiment, the lower the maximum flow rate, the better. The best performing ceramic unit tested was Product F with only a 4.46% maximum flow rate in any one cell. The best performing prior art ceramic unit was Product C with an 8.45% maximum flow rate in any one cell. The best embodiment of the present invention, Product F, performed approximately 47% better than the best performing prior art ceramic unit tested, Product C.

23. Measurements for the percentage of active cells with greater than 3% of total flow and greater than 5% of total flow were also taken. The percentage of active cells with greater than three and five percent of the total flow was determined by comparing the flow rates of the active cells with three and five percent of the total flow rate of the inlet feed stream respectively. With respect to the experiment measuring greater than 3% of total flow, the best performer in accordance with the present invention was Product H with only 8.33% of the cells having a flow rate greater than 3% of the total flow rate. The best performing prior art was Product C with 17.24% of the cells having a flow rate greater than 3% of the total flow rate. In this experiment, the lower the percentage of active cells with greater than 3% of total flow, the better. The present invention, Product H, performed approximately 52% better than the prior art ceramic units, Product C, in this experiment. With respect to the experiment measuring greater than 5% of total flow, the best performer in accordance with the present invention was Product H with 0% of the cells having a flow rate greater than 5% of the total flow rate. The best performing prior art was the Product E with 5.08% of the cells having a flow rate greater than 5% of the total flow rate. In this experiment, the lower the percentage of active cells with greater than 5% of total flow, the better. The present invention, Product C, performed significantly better than the prior art ceramic units, Product E, in this experiment also.

24. To the best of my knowledge and understanding, based upon experiments that I performed, lateral fluid distribution was improved in all performance indicators measured when using the ceramic units of the present invention compared with use of prior art ceramic units.

Product F performed the best consistently when compared with the consistently best performing prior art ceramic filter unit, Product C.

25. The attached Table I demonstrates the amount of lateral fluid distribution that was obtained by using the ceramics of the present invention and prior art ceramic units. As can be seen from the Table I, advantageous properties are associated with the use of the central opening with elliptical openings. The advantageous properties resulting from the use of elliptical openings are unexpected.

26. Crystaphase has enjoyed much commercial success from the sale of these ceramic units. Crystaphase began selling the ceramic units made in accordance with the present invention in 1998. Since then, Crystaphase has sold more than eight million dollars worth of units made in accordance with the present invention, which approximates 40,000 cubic feet of product being sold, which correlates to about 30% – 35% of the total market over the past six years. With so many units sold, the ceramic units should be deemed to have met an unfilled need in the industries in which these ceramic units have been sold.

27. I believe there is no motivation for one of ordinary skill in the field of ceramic filter units to utilize ceramic disc units containing a central circular opening and at least three elliptical openings in accordance with the present invention, at least without resorting to hindsight after viewing the present invention.

28. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Sec. 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the publication or any patent issued thereon.

11/5/03
Date

John N. Glover

TABLE I - SUMMARY OF COLD FLOW EXPERIMENT RESULTS

Shape	PRIOR ART					PRESENT INVENTION		
	Spheres		Cylindrical Openings			Elliptical Openings		
Product	A (3/4" Ceramic balls)	B (3/4" Ceramic balls)	C (5/8" TK-10)	D (7/8" TK-10)	E (5/8" Dypor 607)	F (5/8" BG-1000)	G (7/8" BG-1000)	H (7/8" BG-1002)
Top layer – Depth	6"	12"	6"	6"	6"	6"	6"	6"
Shape	Sphere	Sphere	Disc with 7 cylindrical openings	Disc with 7 cylindrical openings	Disc with one cylindrical opening and six flutes	Disc with four elliptical and one central circular openings	Disc with four elliptical and one central cylindrical openings	Elongated Disc with four elliptical and one central cylindrical openings
Void space	n/a	n/a	55%	55%	60%	60%	60%	63%
Bottom layer – Depth	6"		6"	6"	6"	6"	6"	6"
Size and Shape	¾" Sphere		¾" Sphere	¾" Sphere	¾" Sphere	¾" Sphere	¾" Sphere	¾" Sphere
Void space	~39 %		~39 %	~39%	~39 %	~39 %	~39 %	~39 %
1. Total number of active cells	36	46	58	46	59	86	69	84
2. % of active cells	14.23%	18.18%	22.92%	18.18%	23.32%	33.99%	27.27%	33.20%
3. Area of Active Cells	49	100	143	72	120	180	121	153
4. Number of active cells greater than 5 cells distance from center	0	0	2	0	1	4	2	10
5. Number of active cells greater than 6 cells distance from center	0	0	0	0	0	0	0	3
6. Average Flow Rate per Active Cell	2.78%	2.17%	1.72%	2.17%	1.69%	1.16%	1.45%	1.19%
7. Maximum Flow Rate in a Cell	10.42%	7.03%	8.45%	10.39%	9.07%	4.46%	7.17%	9.74%
8. Percentage of active cells greater than 3% of total flow	27.78%	23.91%	17.24%	26.09%	23.73%	10.47%	8.70%	8.33%
9. Percentage of active cells greater than 5% of total flow	25.00%	8.70%	5.17%	6.52%	5.08%	0.00%	7.25%	3.57%

J

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/320,950	05/27/99	GLOVER J	2797.004

IM62/0426

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EXAMINER	
SORKIN, D	
ART UNIT	**PAPER NUMBER**
1723	4

DATE MAILED: 04/26/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/320,950	GLOVER, JOHN N.	
	Examiner	Art Unit	
	David L. Sorkin	1723	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

1)☒ Responsive to communication(s) filed on *22 November 1999* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-47* is/are pending in the application.

4a) Of the above claim(s) *22-47* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a)☐ All b)☐ Some * c)☐ None of the CERTIFIED copies of the priority documents have been:

1.☐ received.

2.☐ received in Application No. (Series Code / Serial Number) _____ .

3.☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

14) ☒ Notice of References Cited (PTO-892)
15) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
16) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
17) ☒ Interview Summary (PTO-413) Paper No(s). *3* .
18) ☐ Notice of Informal Patent Application (PTO-152)
19) ☐ Other:

DETAILED ACTION

Examiner's Comment

1. It is requested that the applicant provide any additional information known concerning IDS cite no. DT, "Criterion; Top Bed Catalysts and Support", such as the date published and how this document was obtained. Is it part of a larger document? This document appears quite relevant to the instant application.

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-21, drawn to a filtering medium, classified in class 210, subclass 510.1.

II. Claim 22-47, drawn to a method of contacting an organic stream, classified in class 210, subclass 800.

The inventions are distinct, each from the other because of the following reasons:

3. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus could remove contaminants from a stream which is not organic, such as stream of water or air.

4. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

5. Because these inventions are distinct for the reasons given above and the search required for Group II is not required for Group I, restriction for examination purposes as indicated is proper.

6. During a telephone conversation with Ben Tobor on 11 April 2000 a provisional election was made with traverse to prosecute the invention of the filter medium, claims 1-21. Affirmation of this election must be made by applicant in replying to this Office action. Claims 22-47 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Claim Objections

7. Claim 16 is objected to because of the following informalities: "alumina" is listed twice in the "group consisting of statement". Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 1-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10. Claim 1: The meaning of the word "trisoid" is unclear. A full text search of all US patents since issued since 1976 found no instance of the word being used. Three dictionaries were consulted and the word was not found. No definition was found in the specification

11. Claim 5: An elliptical cross-section selected from the group consisting of ellipses and circles is claimed. Since circles are not elliptical, the claim is indefinite, as it is unclear whether circles are within the scope of the claim.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> **A person shall be entitled to a patent unless –**
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

13. Claims 1-3, 6, 8-9, and 14-17 are rejected under 35 U.S.C. 102(b) as being anticipated by Hung (DE 35 39 195).

14. Claim 1: Hung ('195) discloses a filtering medium comprising a plurality of ceramic units at least some of which have a plurality of openings and at least some of the openings are ellipses (see fig. 3 and the Derwent abstract).

15. Claim 2: The units of Hung ('195), discussed above with regard to claim 1, have a thickness of about 0.125 to 1.5 inches (Derwent abstract; note 1 in. = 25.4 mm).

16. Claim 3: The units of Hung ('195), discussed above with regard to claim 1, have closed plane shaped cross-section configuration, each having a width of about 0.25 in. to 3 in. at the widest point (see fig. 1-3; Derwent abstract).

17. Claim 6: The units of Hung ('195), discussed above with regard to claim 1, have a fluted surface (see fig. 3).

18. Claim 8: The units of Hung ('195) have about 20 to 70 percent void area (page 11, lines 5-8).

19. Claim 9: The units of Hung ('195), discussed above with regard to claim 1, have about a 200-500 sq. ft./cu. ft. packing factor (Derwent abstract; note 1/ cm = 30.48 sq. ft./cu. ft.).

20. Claim 14: In the units of Hung ('195), discussed above with regard to claim 1, a Group VI-B metal is impregnated (page 14, lines 19-38; Derwent abstract).

21. Claim 15: In the units of Hung ('195), discussed above with regard to claim 1, a Group VIII metal is impregnated (page 14, line19 to page 15, line 18; Derwent abstract).

22. Claim 16: The units of Hung ('195), discussed above with regard to claim 1, are formed of a ceramic which contains a porous inorganic oxide selected from the group consisting of aluminia, silica, silica-alumina, magnesia, titania (page 14, lines 19-32; Derwent abstract).

23. Claim 17: The units of Hung ('195), discussed above with regard to claim 1, contain metal oxide selected from the group consisting of titanium, tin, lead, zirconium, ruthenium, tungsten, yttrium, nickel, magnesium, calcium, aluminum, silicon, or boron page 14, line19 to page 15, line 18; Derwent abstract).

Claim Rejections - 35 USC § 103

24. Some claims are rejected under U.S.C. 103 rather than 102 because it is unclear what is being claimed, as discussed above with regard to U. S. C. 112, especially concerning the meaning of trisoid.

25. Claims 4-5, 7, and 10-13 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung ('195).

26. Claim 4: The medium of Hung ('195) is discussed above with regard to claim 1. It is stated that the cross-section can be inscribed in a rectangle with each side in the range 1/8 to 3 in. (page 9, lines 8-25; Derwent abstract). While the shape is rounded off from a rectangle, it is considered that it would have been obvious to one of ordinary skill in the art to make the cross-section rectangular.

27. Claim 5: The medium of Hung ('195) is discussed above with regard to claim 1. A generally elliptical cross-section with minor axis from ¼ to 2 in. and major axis from 3/8 to 3 in. is disclosed (fig. 3, page 9, lines 8-25).

28. Claim 7: The medium of Hung ('195) is discussed above with regard to claim 1. An irregularly shaped surface (due to rib; see fig. 3 and Derwent abstract) is disclosed.

29. Claim 10: The medium of Hung ('195) is discussed above with regard to claim 1. Ceramic units comprising a catalyst including porous alumina and a group VI-B metal are also disclosed (page 14, lines 19-38; Derwent abstract). Although it is not explicitly stated that this is in the form of a coating, it is considered that it would have been obvious to one of ordinary skill in the art to have made the catalyst in the form of a coating.

30. Claim 11: In the medium of Hung ('195), discussed above with regard to claim 10, molybdenum is disclosed as a possible group VI-B metal (page 14, line 36).

31. Claim 12: The medium of Hung ('195) is discussed above with regard to claim 1. Ceramic units comprising a catalyst including porous alumina and a group VIII metal are also disclosed (page 14, line19 to page 15, line 18; Derwent abstract). Although it is not explicitly stated that this is in the form of a coating, it is considered that it would have been obvious to one of ordinary skill in the art to have made the catalyst in the form of a coating.

32. Claim 13: In the medium of Hung ('195), discussed above with regard to claim 12, nickel or cobalt is disclosed as a possible group VIII metal (page 15, line 1).

33. Claim 21: The medium of Hung ('195) is discussed above with regard to claim 1. Units made of zeolite are discloses (page 14, line 28). Although zeolites L, X, or Y are not disclosed it is considered that it would have been obvious to one of ordinary skill in the art to select one of these zeolites.

34. Claims 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hung ('195) in view of Whitman (US 5,399,535).

35. Claim 18: The medium of Hung ('195) is discussed above with regard to claim 1. Hung ('195) fails to disclose a ceramic filter containing a metal nitride. Whitman ('535) teaches units containing a metal nitride selected from the group consisting of titanium, zirconium, tungsten, silicon or boron (claim 6). It is considered that it would have been obvious to one of ordinary skill in the art to make units of Hung ('195) contain a metal nitride of Whitman ('535) because Hung ('195) teaches variations in what metals are compound with (see Derwent abstract).

36. Claim 19: The medium of Hung ('195) is discussed above with regard to claim 1. Hung ('195) fails to disclose a ceramic filter containing a metal carbide. Whitman ('535) teaches units containing a metal carbide selected from the group consisting of titanium, zirconium, tungsten, silicon or boron (claim 7). It is considered that it would have been obvious to one of ordinary skill in the art to make units of Hung ('195) contain a metal nitride of Whitman ('535) because Hung ('195) teaches variations in what metals are compound with (see Derwent abstract).

37. Claim 20: The medium of Hung ('195) is discussed above with regard to claim 1. Hung ('195) fails to disclose a ceramic filter containing a metal boride. Whitman ('535) teaches units containing a metal nitride selected from the group consisting of titanium, zirconium, or tungsten (claim 8). It is considered that it would have been obvious to one of ordinary skill in the art to make units of Hung ('195) contain a metal nitride of Whitman ('535) because Hung ('195) teaches variations in what metals are compound with (see Derwent abstract).

38. Claims 1, 4, and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Joulin et al. (US 5,895,572).

39. Claim 1: Joulin et al. ('572) discloses a filtering medium comprising a plurality of ceramic units at least some of which have a plurality of openings and at least some of the openings are trisoids (fig. 1-3).

40. Claim 4: The units of Joulin et al. ('572) are disclosed to have hexagonal cross-sections (fig. 3).

41. Claim 5: The units of Joulin et al. ('572) are disclosed to have circular cross-sections having diameters ranging from 0.25 to 3 in. (fig. 1 and 2; claim 10).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David L. Sorkin whose telephone number is 703-308-1121. The examiner can normally be reached on 7:30 - 5:00 Mon.-Thur., Alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda L. Walker can be reached on 703-308-0457. The fax phone numbers for the organization where this application or proceeding is assigned are 703-305-7718 for regular communications and 703-305-3599 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

David Sorkin

April 17, 2000

W. L. WALKER
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